995,535

# PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

## Improvements in and relating to Shuttle Valves

We, HOERBIGER VENTILWERKE AKTIENGESELLSCHAFT, an Austrian company, of 23 Braunhubergasse, Vienna XI, Austria, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a shuttle valve for pneumatic or hydraulic control systems, comprising a housing with a cylinder bore therein being closed on its opposite ends by cover plates or the like, in which cylinder bore a control piston, sealed by means of gaskets, is axially slidable, controlling selectively the connection between one of two feed ports communicating with the cylinder bore at the opposite ends thereof and a discharge port radially branching off an enlargement of the cylinder bore.

In a conventional shuttle valve of this type, wherein the gaskets serving for the sealing of the control piston are inserted in grooves of the cylinder bore on both sides of its enlargement, the control piston is relatively long as compared with the axial distance between the two gaskets, so that it overlaps the enlargement of the cylinder bore and closely adjoins the two gaskets also in its extreme positions. Although this arrangement provides adequate support for the gaskets and concentric guidance of the piston during the entire stroke movement, the length of the piston is responsible for considerable drawbacks both of a structural and functional nature. As the piston permanently overlaps the enlargement of the cylinder bore, longitudinal grooves must be provided at its extremities to ensure the proper connection between the open feed port and the discharge port originating at the enlargement. Moreover, passages are provided in the cover plates simultaneously forming the limit stops for the control piston, in the proximity of their periphery, said passages communicating with the longitudinal grooves of the piston, it beng necessary to use appropriate precautions to prevent coverage of these passages by the connecting screws of the feed pipes connected to the feed ports. In addition to the complicated design of this conventional valve a notable functional drawback resides in the comparatively massive size of the control piston and in the hard impact of same on the cover plates.

This invention improves this conventional design by providing a control piston, which in each of its extreme positions seals the cylinder bore with one of its extremities and protrudes freely into the enlargement of the cylinder bore with its other extremity, thereby being concentrically guided in the said cylinder bore by the cylinder bore itself at the said one extremity and by an additionally provided guiding means at the said other extremity, the axial distance between the sealing edges of the gaskets adjoining the cylinder bore being larger than the axial length of the enlargement of the cylinder bore. With this design the connection between the open feed port and the discharge port is provided by an annular clearance between the control piston and the enlargement of the cylinder bore, so that special passages inside the piston may be dispensed with, the piston being constituted by a solid turned element. The gaskets are preferably located in peripheral grooves of the control piston at an axial distance somewhat larger than the dimensions of the enlargement in an axial direction, so as to preclude an open connection between the two feed ports in any position of the control piston. Suppression of the longitudinal grooves in the piston also affords better utilization of the available cross-sectional area for flow purposes. The piston may be substantially shorter and the dimensions of the shuttle valve according to the invention can be considerably smaller than the conventional type. In addition, the auxiliary guiding means assures positive guidance of the control piston over the entire length of the stroke.

According to a preferred embodiment of

[*Price 4s. 6d.*]

the invention the control piston is provided with preferably cylindrical recesses in its opposite ends, hollow extensions originating with the cover plates protruding into the said recesses, the said extensions presenting at least over part of their length cutouts, perforations or the like extending through them in a radial direction, the control piston being conveniently guided with great accuracy by the hollow extensions serving as an auxiliary guiding means, and of a particularly compact design. The cutouts, perforations or the like constitute so many passages for the pressure medium when the valve is open. If the extensions are perforated only in the areas of their free extremities, whereas for the rest of their length they present a closed circumference, and when the piston covers the cutouts, perforations or the like during the closing motion, the narrow clearance between the extensions and the recesses in the control piston produces a throttling cross-section through which the pressure medium trapped between the extensions and the cylinder bore can escape only slowly, thereby retarding the motion of the piston which will thus impinge upon the cover plates at reduced speed.

According to a further embodiment of the invention, the hardness of the impact of the piston upon the cover plates can be further attenuated by the provision of washers made of an impact-attenuating material such as rubber, plastics or the like on the inner surfaces of the cover plates of the housing, said washers serving preferably also as an additional sealing means. In a simple and convenient manner the washers made of rubber, plastics or the like protrude radially over and above the periphery of the cylinder bore and are clamped between the cover plates and the housing so as to provide additional and adequate sealing for the cover plates.

According to still another embodiment of the invention the control piston comprises two piston discs fitting into the cylinder bore and sealed against the latter by means of gaskets located in circumferential grooves and interconnected by means of an intermediate guide rod located in a sliding bearing provided in the area of the enlargement of the cylinder bore. This design of the shuttle valve according to the invention comprises plain turned parts only.

Further optional details of the invention will appear from the following description of several embodiments of the invention with reference to the accompanying drawings in which:

Fig. 1 is a longitudinal sectional view of a preferred embodiment and

Fig. 2 shows a front view of the said embodiment, partly in section taken along the line II—II of Fig. 1.

Fig. 3 is a longitudinal sectional view of another embodiment of the invention.

In both embodiments, reference number 1 designates the housing of the shuttle valve, number 2 the cylinder bore provided in the housing 1 and number 3 the control piston slidably arranged in the cylinder bore. On its opposite ends the cylinder bore 2 is closed by means of cover plates 4 and 5 presenting connecting bores or ports 6 and 7 for two feed pipes (not shown) terminating at the opposite ends of the cylinder bore 2 and secured to the housing 1 by means of screws 8. The discharge pipe originates at a connecting bore or port 9 in the housing 1 branching off radially from an enlargement 10 of the cylinder bore 2. Transverse bores 11 also provided in the housing 1 serve for the attachment of the valve.

In the vicinity of its extremities the control piston 3, sliding inside the cylinder bore 2 between two extreme positions determined by the cover plates 4 and 5, presents circumferential grooves in which gaskets 12 and 13 are inserted. In its extreme positions, the control piston abuts with one extremity against one of the cover plates, sealing the cylinder bore 2 off in that place, so as to shut off the feed pipe terminating there, whereas the other extremity of the control piston 3 protrudes freely into the enlargement 10 of the cylinder bore 2, so as to define an annular clearance between the piston 3 and the enlargement 10, the other feed pipe communicating with the discharge pipe. In order to preclude any connection between the two feed pipes, the axial distance between the two gaskets 12 and 13 is larger than the length of the enlargement 10 as measured in an axial direction. The control piston 3 is displaced from one extreme position to the other by the pressure in the feed pipes. Consequently, only the feed pipe in which the higher pressure prevails will be connected with the discharge pipe.

During the displacement of the control piston 3 and in both extreme positions of same only one of the extremities of the control piston 3 is concentrically guided by the cylinder bore 2 itself. However, an additional auxiliary guiding means is provided, by which the extremity of the control piston 3 which freely protrudes into the enlargement 10 is also permanently guided in concentric relation to the cylinder bore 2. In the embodiment illustrated in Figs. 1 and 2, the auxiliary guiding means consists of hollow extensions 16 and 17 originating from the cover plates 4 and 5 and protruding into cylindrical recesses 14 and 15 at the opposite ends of the control piston 3, said extensions being provided with cutouts 18 and 19 for the passage of the pressure medium. At the inner surfaces, the cover plate 4 and 5 present washers 20 and 21 made of rubber, plastics or the like arranged around the extensions 16, 17 and serving to attenuate the impact of the control

piston 3 on the cover plates and simultaneously as an additional sealing means for the valve. In this embodiment of the invention, the washers 20, 21 also serve to seal the cover plates 4, 5 off against the housing 1, as they protrude over and above the periphery of the cylinder bore 2 and are clamped between the cover plates 4, 5 and the housing 1.

In the embodiment illustrated in Fig. 3 the control piston is of a split design and comprises two piston discs 22 and 23, carrying the gaskets 12 and 13 and interconnected by means of a guide rod 24. The piston discs 22, 23 are secured to the guide rod 24 by means of bolts 25 and 26. The auxiliary guiding means consists of a sliding bearing 27 provided in the enlargement 10 of the cylinder bore 2, and wherein the guide rod 24 is arranged. Again, the axial distance between the gaskets 12 and 13 is larger than the length of the enlargement 10, so as to preclude any interconnection between the two feed pipes, whatever the position of the control piston 3.

WHAT WE CLAIM IS:—

1. A shuttle valve for pneumatic or hydraulic control systems, comprising a housing with a cylinder bore therein being closed on its opposite ends by cover plates or the like, in which cylinder bore a control piston, sealed by means of gaskets is axially slidable, controlling selectively the connection between one of two feed ports communicating with the cylinder bore at the opposite ends thereof and a discharge port radially branching off an enlargement of the cylinder bore, characterized in that the control piston in each of its extreme positions, seals the cylinder bore with one of its extremities and protrudes freely into the enlargement of the cylinder bore with its other extremity, thereby being concentrically guided in the said cylinder bore by the cylinder bore itself at the said one extremity and by an additionally provided guiding means at the said other extremity, the axial distance between the sealing edges of the gaskets adjoining the cylinder bore being larger than the axial length of the enlargement of the cylinder bore.

2. A shuttle valve as claimed in claim 1, characterized in that the control piston is provided with preferably cylindrical recesses on its opposite ends, hollow extensions originating with the cover plates protruding into the said recesses, the said extensions presenting at least over part of their length cut-outs, perforations or the like extending through them in a radial direction.

3. A shuttle valve as claimed in claim 1 or 2, characterized in that the cover plates of the housing are provided with washers of an impact-attenuating material on their inner surfaces, the said washers serving preferably also as an additional sealing means.

4. A shuttle valve as claimed in claim 3, characterized in that the washers made of rubber, plastics or the like protrude radially over and above the periphery of the cylinder bore and are clamped between the cover plates and the housing so as to provide additional sealing.

5. A shuttle valve as claimed in any of claims 1 to 4, characterized in that the control piston comprises two piston discs fitting into the cylinder bore and sealed against said cylinder bore by means of gaskets located in circumferential grooves and interconnected by means of an intermediate guide rod located in a sliding bearing provided in the area of the enlargement of the cylinder bore.

6. A shuttle valve substantially as hereinbefore described and as illustrated in and by the accompanying drawing.

MARKS & CLERK,
Chartered Patent Agents.
Agents for the Applicants.

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1 SHEET This drawing is a reproduction of the Original on a reduced scale

FIG. 1

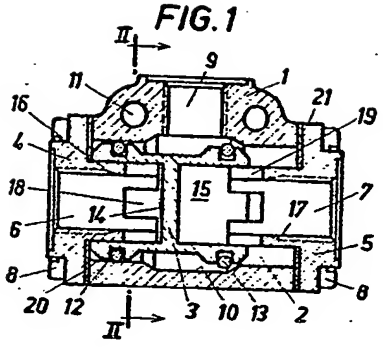


FIG. 2

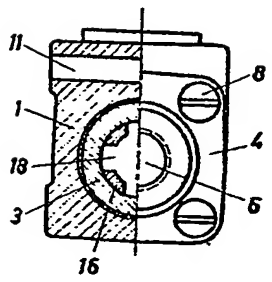


FIG. 3